

Degree	Type	Year
4313792 Neurosciences	OB	0

## Contact

Name: Alfonso Rodriguez Baeza

Email: [alfonso.rodriguez@uab.cat](mailto:alfonso.rodriguez@uab.cat)

## Teachers

Joaquín Martí Clua

Maria Luisa Ortega Sánchez

Beatriz Almolda Ardid

## Teaching groups languages

You can view this information at the [end](#) of this document.

## Prerequisites

The requirements are those for access to the master's program. It is necessary to have a sufficient level of English for classes taught in this language.

## Objectives and Contextualisation

The general objective is to understand the basic cellular, structural and anatomical characteristics of the Central and Peripheral Nervous System that will allow students to understand research in neuroscience and provide the basis for understanding the pathologies affecting this system.

## Learning Outcomes

1. CA01 (Competence) Explain the different anatomical structures and cellular basis of the nervous system to both specialists in neuroanatomy and cellular neurobiology, as well as to a lay audience.
2. CA02 (Competence) Relate the tissue architecture of different areas of the nervous system to interpret their structure and function.
3. CA03 (Competence) Assess the existence of gender inequalities in neuroanatomy and cellular neurobiology.
4. KA01 (Knowledge) Recognise the anatomical organisation of the nervous system.

5. KA02 (Knowledge) Identify the neuronal and glial variabilities present in the nervous system.
6. KA03 (Knowledge) Indicate the embryonic origin of the different areas of the nervous system and their cellular contingent.
7. SA01 (Skill) Discover the embryonic origins of the different areas of the nervous system.
8. SA02 (Skill) Analyse the areas of the nervous system.
9. SA03 (Skill) Analyse histological sections of the central and peripheral nervous systems.

## Content

### THEORY AND PRACTICAL SKILLS

#### DEVELOPMENT OF THE NERVOUS SYSTEM (Alfonso Rodríguez-Baeza)

Zygote, Morula and Blastula. Gastrulation. Primary and secondary neurulation. Spinal cord formation. Early vesicles and flexures: Rhombencephalon, Mesencephalon and Prosencephalon. Secondary vesicles and derivatives: Myelencephalon, Metencephalon, Mesencephalon, Diencephalon and Telencephalon. Cerebral cortex formation. Basal nuclei formation. Hippocampal formation. Neural crest and derivatives. Ectodermal placodes. Peripheral nervous system formation: spinal and cranial nerves. Autonomic nervous system formation. Overview of the sense organs formation. The perinatal nervous system.

#### CELLULAR NEUROBIOLOGY (Beatriz Almolda Ardid)

Cytology of neurons. Neuronal cytoskeleton: mechanisms of axonal transport. Dendritic arborisation and synaptic terminals. Astrocytes: metabolism, cytoskeleton, function and cell subtypes. Structure and function of blood-brain barrier. Microglia: metabolism, functions and cell types. Radial glia: Characteristics and functions. Ependymocytes and tanycytes: localization, characteristics and functions. PNS satellite glia. Myelination: oligodendrocytes and Schwann cells. CNS and PNS myelination. Molecular structure of myelin. Paranode and fissures. Ranvier node in CNS and PNS. Glia-glia and neuron-glia communication: contact and soluble signalling factors.

#### NEUROGENESIS AND GLIOGENESIS (Joaquim Martí Clua)

Prenatal, perinatal, and postnatal neurogenesis. Timetables of neurogenesis. Use of tritiated thymidine and bromodeoxyuridine. Migration and neuronal fate: involvement of the radial glia. Convergent and divergent migrations. Neurogenetic gradients. Glia cells generation. Stem cells, progeny, and final location. Origin of the adult stem cells: radial glia cells. Neurogenetic regions in the adult brain: glial and neuron production. Animal models and human studies. Neural stemcells and cancer stem cells. Origin and development of the brain cancers.

#### NEUROANATOMY (Alfonso Rodríguez-Baeza).

Introduction to the anatomical organization of the CNS. Overview of the brain: lateral, vertical and basal aspects. Overview of the skull and cranial meninges organization. Cerebrum: cerebral hemispheres, basal ganglia and diencephalon. Brain stem: medulla oblongata, pons and midbrain. Cerebellum. Reticular formation. Spinal cord: morphology and overview spinal nerves systematization. Overview of the spine and spinal meninges organization. Ventricular system and cerebrospinal fluid circulation. Cranial nerves: nuclei of origin, pathway and overview of the peripheral distribution. Overview of the special senses: olfaction, vision, taste, hearing and balance. Overview of the autonomic nervous system: sympathetic and parasympathetic. Overview of the ascending and descending pathways. CNS vascularisation: arteries and veins. Basic notions of comparative neuroanatomy.

#### NEUROHISTOLOGY (Beatriz Almolda Ardid)

Basic structure of nervous tissue. Microscopic structure of peripheral nerve and ganglia. Spinal cord: organization of grey and white matter. Cerebellum: Organization of grey and white matter. Cortical

cytoarchitecture. Brain. Neocortex. Cytoarchitecture of neocortical layers. Brain. Limbic system. Hippocampal cytoarchitecture. Ventricles and choroid plexus. Meninges: organization and structure. Basic techniques for the histologic study of the nervous system.

## PRACTICAL SESSIONS IN LAB

Neurohistology Laboratory (Beatriz Almolda Ardid)

Analysis of microscopic slides using histological and immunohistochemical techniques. Study of specific cellular markers in neuropathological tissues (Alzheimer's disease, Multiple Sclerosis, etc.).

Performing immunocytochemical staining in mixed glia cell cultures (astrocytes, oligodendrocytes, and microglia) and/or mouse or rat brain tissues to determine different neural subpopulations (from undifferentiated to mature cells).

Dissection Room (Alfonso Rodríguez-Baeza and Marisa Ortega Sánchez)

Observation of anatomical structures in preparations and topographic sections of the human nervous system.

## Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Cellular Neurobiology, Neurogenesis and Gliogenesis, and Neurohistology	26	1.04	CA01, CA02, CA03, KA02, KA03, SA01, SA02, SA03, CA01
Neuroanatomy and development of Nervous System	26	1.04	CA01, CA03, KA01, KA03, SA01, SA02, CA01
Type: Supervised			
On line activities and tutorials	50	2	CA03, KA01, KA02, KA03, SA01, CA03
Type: Autonomous			
Personal study, comprehension and reading articles, conceptual assimilation of contents	113	4.52	CA01, CA03, KA01, KA02, KA03, SA01, SA02, CA01

## GUIDED ACTIVITIES:

**THEORETICAL CLASSES** (typology TE) Teaching of an essentially expository nature that is usually carried out in a classroom at a pre-scheduled time. The student acquires the knowledge of the module by attending theory classes and supplementing them with personal study of the topics taught.

**LABORATORY PRACTICES** (typology PLAB) An activity that involves carrying out practical work that requires the student to use specific infrastructure (dissection room, Histology laboratory). They are performed in a specially equipped location, at a specific time, and with the continuous assistance of the teaching staff. They are scheduled at specific times and spaces. For the dissection room practices of the Faculty of Medicine, it is **MANDATORY** to wear a lab coat and gloves, and it is not allowed to take photographs and/or videos in the dissection room. A certificate that authorizes them to carry out the practices in the dissection room must be available.

## SUPERVISED ACTIVITIES:

ON-LINE ACTIVITIES AND TUTORIALS: Teaching taught without classroom attendance and intensively using information and communication technologies (ICT). Students have complementary teaching material for the different training activities through the UAB Campus Virtual, and personal tutorials with the teacher (upon request).

## AUTONOMOUS ACTIVITIES:

Comprehension and reading articles. Personal study, implementation of schemes and summaries, conceptual assimilation of the course content.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

## Assessment

### Continuous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Continues evaluation	10%	4	0.16	CA01, CA03, KA01, KA02
Evaluation of Lab practices (Anatomy and Histology)	10%	2	0.08	CA01, CA02, CA03, KA02, SA02, SA03
Objective written evaluation of Anatomy contents	40%	2	0.08	CA01, CA03, KA01, KA03, SA01, SA02
Objective written evaluation of Histology contents	28%	1.5	0.06	CA01, CA02, CA03, KA02, KA03, SA01, SA02
Objective written evaluation of Neurogenesis contents	12%	0.5	0.02	CA01, CA02, CA03, KA02, KA03, SA01, SA02

### Evaluation of the module

The module competencies will be evaluated through different activities:

- A continuous assessment through active participation in different directed training activities, which will represent 10% of the final score with a minimum attendance of 80%
- A structured objective evaluation in Anatomy Lab practices, which will represent 5% of the final score
- A structured objective evaluation in Histology Lab practices, which will represent 5% of the final score
- A written evaluation through objective tests of limited response and recognition of structures from the contents taught in the Anatomy classes, which will represent 40% of the final score
- A written evaluation through objective tests of short response and recognition of structures from the contents taught in the Histology classes, which will represent 28% of the final score
- A written evaluation through objective tests of limited response from the contents taught in the Neurogenesis classes, which will represent 12% of the final score

To apply these weightings, it is necessary:

- Not to have a 0,0 in any of these evaluable activities, and

- to have obtained a minimum grade of 4.5 out of 10.0 in each of the following objective tests: Anatomy Lab practices, Histology Lab practices, written evaluation of Anatomy, written evaluation of Histology and written evaluation of Neurogenesis.

To pass the module, a grade of 5.0 or higher must be obtained once the percentages and requirements have been applied.

Students who have not passed the module will have the possibility to take a recovery exam that will consist of:

- A written evaluation by means of objective test of limited response and recognition of structures from the contents taught in the Anatomy classes
- A written evaluation by means of objective test of short answer and recognition of structures of the contents taught in the Histology classes
- A written evaluation by means of objective test of limited response of the contents taught in the Neurogenesis classes

The continuous assessment, as well as the objective structured evaluation of the laboratory practices of Anatomy and/or Histology, by their very nature, are NOT recoverable.

In order to take the recovery exam, students must have been previously assessed in a set of activities whose weight is equivalent to at least two-thirds of the total grade for the subject or module. Students will receive a grade of "Not Evaluated" when the completed assessment activities account for less than a third of the final grade.

The single assessment system is not planned in this module.

## Bibliography

### BIBLIOGRAPHY

Anastasi, G., Gaudio, E., TACCHETTI, C. (Alfonso Rodríguez Baeza editor edición en español) (2022) Anatomía humana - atlas - 2ª ed. Ed. Edra ediciones

Carlson, B.M. (2019) Embriología humana y Biología del Desarrollo. 6ª ed. Ed. Elsevier. [Accés restringit als usuaris de la UAB. Cal registrar-se prèviament](#)  
<https://www.clinicalkey.com/student/content/toc/3-s2.0-C20180056236>

Crossman, AR., Neary, D. (2019) Neuroanatomía: Texto y Atlas en color. 6ª ed. Ed. Elsevier. [Accés restringit als usuaris de la UAB. Cal registrar-se prèviament](#)  
<https://www.clinicalkey.com/student/content/toc/3-s2.0-C2019000684X>

Dauber, W. (2021) Feneis Nomenclatura Anatómica Ilustrada. 11ª ed. Ed. Elsevier.

Felten, DL., O'Banion, MK., Maida, ME. (2016) Netter Atlas de Neurociencia. 3ª ed. Ed. Elsevier. [Accés restringit als usuaris de la UB, UAB, UPC, UPF, UdG, UdL, URV, UVic-UCC i UJI](#)  
<https://www.sciencedirect.com/science/book/9780323265119>

Haines, D.E., Mihailoff, G.A. (2019) Principios de Neurociencia. Aplicaciones básicas y clínicas. 5ª ed. Ed. Elsevier. [Accés restringit als usuaris de la UAB. Cal registrar-se prèviament](#)  
<https://www.clinicalkey.com/student/content/toc/3-s2.0-C20170037795>

Haines, DE. (2021) Neuroanatomía clínica. Texto y Atlas. 10ª ed. Ed. Wolters Kluwer. [Accés restringit als usuaris de la UB i UAB](#) <https://cienciasbasicas.lwwhealthlibrary.com/book.aspx?bookid=2873>

Hussain G, Akram R, Anwar H, Sajid F, Iman T, Han HS, Raza C, De Aguilar JG. Adult neurogenesis: a real hope or a delusion? Neural Regen Res. 2024 Jan;19(1):6-15. doi: 10.4103/1673-5374.375317.

Junqueira, L.C., Carneiro, J. (2022) Histología Básica. 13ª ed. Ed. Médica Panamericana.

Kandel, E.R., Koester, J.D.; Mack, S.H. Siegelbaum, S.A. (2021) Principles of Neural Science. 6<sup>th</sup> ed. Ed. McGraw Hill. [Accés restringit als usuaris de la UAB http://lib.mylibrary.com/?id=396874](http://lib.mylibrary.com/?id=396874)

Li Y, Xu NN, Hao ZZ, Liu S. Adult neurogenesis in the primate hippocampus. Zool Res. 2023 Mar 18;44(2):315-322. doi: 10.24272/j.issn.2095-8137.2022.399. PMID: 36785898; PMCID: PMC10083228.

Mai, J.K., Paxinos, G. (2011) The Human Nervous System. 3<sup>rd</sup> ed. Ed. Elsevier. [Accés restringit als usuaris de la UAB http://lib.mylibrary.com/Open.aspx?id=334767](http://lib.mylibrary.com/Open.aspx?id=334767)

Matthews G.G. (2000) Neurobiology. Molecules, Cells and Systems. 2<sup>nd</sup> ed. Ed. John Wiley & Sons.

Moore, KL., Persaud, TVN., Torchia, MG. (2019) The Developing Human. Clinically Oriented Embryology. 11<sup>a</sup> ed. Ed. Elsevier.

Mtui, E., Gruener, G., Dockery, P. (2017) Fitzgerald. Neuroanatomía Clínica y Neurociencia. 7<sup>a</sup> ed. Ed. Elsevier.

Pawlina, W. (2020) Ross. Histología: Texto y atlas. 8<sup>a</sup> ed. Ed. Wolters Kluwer.

Purves, D., Augustine, G.J., Fitzpatrick, D, et al (2018) Neuroscience. 6<sup>th</sup> ed. Ed. Oxford University Press. [Accés restringit als usuaris de la UAB http://www.medicapanamericana.com/VisorEbookV2/Ebook/9788498359831](http://www.medicapanamericana.com/VisorEbookV2/Ebook/9788498359831)

Sadler, TW. (2019) Langman. Embriología Médica. 14<sup>a</sup> ed. Ed. Wolters Kluwer. [Accés restringit als usuaris de la UB i UAB https://cienciasbasicas.lwwhealthlibrary.com/book.aspx?bookid=2899](https://cienciasbasicas.lwwhealthlibrary.com/book.aspx?bookid=2899)

Simard S, Matosin N, Mechawar N. Adult Hippocampal Neurogenesis in the Human Brain: Updates, Challenges, and Perspectives. *The Neuroscientist*. 2024;0(0). doi:[10.1177/10738584241252581](https://doi.org/10.1177/10738584241252581)

Spittgerber, R. (2019) Snell Neuroanatomía clínica. 8<sup>a</sup> ed. Ed. Wolters Kluwer.

Squire, L.R., Berg, D., Bloom, F.E. et al. (2012) Fundamental Neuroscience. 4<sup>th</sup> ed. Ed. Elsevier.

Standring, S. (2020) Gray's Anatomy: The Anatomical Basis of Clinical Practice. 42<sup>th</sup> ed. Ed. Elsevier.

ten Donkelaar, H.J.; Kachlik, D.; Tubss, R.S. (2018) An Illustrated Terminologia Neuroanatomica. A Concise Encyclopedia of Human Neuroanatomy. 1st ed. Ed. Springer

Vanderah, TH., Gould DJ. (2020) Nolte's the Human Brain. An introduction to its functional Anatomy. 8<sup>a</sup> ed. Ed. Elsevier. [Accés restringit als usuaris de la UAB https://ebookcentral.proquest.com/lib/UAB/detail.action?docID=2036217](https://ebookcentral.proquest.com/lib/UAB/detail.action?docID=2036217)

Waxman, SG. (2007) Molecular Neurology. 1<sup>st</sup> ed. Ed. Elsevier. [Accés restringit als usuaris de UB, UAB https://www.sciencedirect.com/science/book/9780123695093](https://www.sciencedirect.com/science/book/9780123695093)

Access to the module by the UAB Campus Virtual

The library's website can be consulted for "on line" bibliography

## Software

Is not necessary specific software

## Language list

Name	Group	Language	Semester	Turn
(PLABm) Practical laboratories (master)	1	Catalan/Spanish	first semester	morning-mixed
(PLABm) Practical laboratories (master)	2	Catalan/Spanish	first semester	morning-mixed
(TEm) Theory (master)	1	Spanish	first semester	morning-mixed